answers this question only as regards physical science, and his answer is "contained in that to another question, What is the object of the physical sciences?" The whole concludes with words of the late Prof. H. Smith on the function of mathematics in education.

ACOUSTICS

Hand-book of Acoustics. By T. E. Harris, B.Sc., Lecturer on Acoustics at the Tonic Sol-fa College. (London: J. Curwen and Sons.)

A FEW years ago some wiseacre had the temerity to propound the idea that the scientific and historical data on which music is founded have no bearing on music itself, and need form no part of the knowledge to be acquired by a musician. It is quite true that a man may get through life very comfortably as a singer, a fiddler, or a pianoforte-player, without ever having heard of sound-waves or of the Greek modes; but as regards a knowledge of music in a higher sense the idea is absurdly untrue. The moment we approach the *theory* of music we find the scientific and historical elements confront us at every step, and all attempts to form an intelligible explanation of musical structure without reference to them have been, and must be, failures. In fact, no rational theory of music can exist unless founded on such a basis. This fact is now pretty generally acknowledged by those who have to do with musical education. All examining bodies of any weight require an acquaintance with the data referred to, and all well-constituted courses of teaching include them.

The book now before us is a remarkable instance of this. The Tonic Sol-fa movement is what we may call ultra-practical: its supporters aim at teaching music to the great masses of the people, and their system is purposely contrived to facilitate its practical acquirement, and to bring it down to the proverbial "meanest capacity." Yet the Tonic Sol-fa authorities think it right to have a Lecturer on Acoustics, and to publish a hand-book of the science for the use of their millions of pupils. This is certainly about the severest reproof that could be given to the foolish "practical" notion that would exclude intellectual topics from musical study.

There is not much to say about the book itself. It is an unpretending compilation of the most important facts of the science, gathered from various authentic sources, intelligently stated, and without any crotchetiness or affectation of originality. The peculiar feature, of course, is that the musical illustrations are, wherever possible, given in the Tonic Sol-fa notation. Perhaps, in the 286 closely-printed pages, there is more elaboration of detail than the students may care for; but this is to a certain extent counterbalanced by a condensed summary being added at the end of each chapter.

It would have been an advantage if more copious and complete references had been given to other and more original works, from which the matter has been taken. It is, or should be, one of the most important objects of a "hand"-book to enable students, if they desire it, to put more complete treatises on their study-table. There is no date either on the title or in the preface—a very bad habit of music publishers.

OUR BOOK SHELF

Old or New Chemistry: Which is Fittest for Survival? By Samuel Phillips, F.C.S. (London: Wertheimer, Lea, & Co., 1886.)

THIS small book is a collection of essays more or less bearing on the subject indicated by the title, and may perhaps be also described as a sort of protest against a grievance. The elevating and spurring effect of the possession of a grievance is well known, and it must be admitted that in this case it has, apparently at least, contributed to the production of a very entertaining little book, which will no doubt, as it is intended, "wake up" chemists generally to a clear perception of their absurd and useless theories of chemical constitution.

It is, however, doubtful whether the book will really do anything to forward the science of which the author professes to be such an ardent lover. As to Avogadro's law and the laws known as Dulong and Pettit's, however scanty a basis they may have in experimental facts, they have been useful, and will be until they are supplanted by wider-reaching theories. It is exactly here that the author seems to be too conservative. We not only want more facts—as many facts as we can get—but we want theories as well, if they will only again lead to new facts. And, moreover, what is wanted in this country is for chemists to *work*. There is no lack of problems waiting to be solved.

What we do not want is any further multiplication of "fads." Nothing is gained by writing "Ph" for C_6H_5, and the "equivalent symbol" for "etholo-aceto-acetic acid," viz.,

$$\left.\begin{matrix}432\\432\\45\end{matrix}\right\}1294,\ \mathrm{O.HO},$$

at page 19, is no advance but retrogression.

Lectures and Essays. By the late W. K. Clifford, F.R.S. Edited by Leslie Stephen and Frederick Pollock. With an Introduction by F. Pollock. Second Edition. (London: Macmillan and Co., 1886.)

THIS collection of lectures and essays is already so well known that it is now necessary only to note the fact that a second edition has appeared. Two essays have been omitted as being rather mathematical than philosophical, namely, those on "Types of Compound Statement" and on "Instruments used in Measurement." They have found a more fitting place in the volume of "Mathematical Papers" published in 1882. The admirable biographical Introduction by Mr. Pollock has been revised, and some additions and omissions have been made in the extracts there given.

Lives of the Electricians. By William T. Jeans. (London: Whitaker and Co., 1886.)

AN extremely well-compiled and interesting book; but why did the author commence with the life of a living professor, who is not an electrician? Faraday, as the brightest electrical light of this or any other age, should have headed the series. The author has a rich store of names to draw upon—Gilbert, Coulomb, Arago, Snow Harris, Franklin, Cavendish, Galvani, Volta, Henry Davy, Ronalds, Oersted, Ampère, De la Rive, Ohm, Schilling, Gauss, Weber, Daniell, Crosse, Steinheil—without trenching on living celebrities. The work is very impartially written. The life of Morse might have been written by an enthusiastic American, while Wheatstone's friends cannot complain of the eulogy of their hero.

Some statements want revision. The inauguration of the cable system can scarcely be fairly narrated without mention of Messrs. Crampton and Wollaston. Varley's long artificial cable and great experiment shown at the Royal Institution are accredited to Prof. Tyndall (p. 95). The statement attributed to Sir Robert Inglis (p. 285)

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that in 1847 England was behind America must surely be wrong. The Electric Telegraph Company in England was then in full swing.

As this is the jubilee year of the telegraph in England, it is well to be reminded that Cooke and Wheatstone made their first practical and successful trial on July 25, 1837, between Euston and Camden, while Morse did not file his *caveat* (*i.e.* did not apply for his patent) until October 5 of the same year.

We wish the book every success, and shall be glad to see further instalments.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Normal School of Science and Royal School of Mines

I AM directed to request that you will be so good as to allow me to state, through the medium of your columns, that the number of applications for admission to the Normal School of Science and Royal School of Mines at South Kensington, at the commencement of the present session, having been considerably in excess of the accommodation which the School can afford, it has become necessary to adopt some process of selection for the future. Hereafter, applications for admission should be sent to the Registrar of the School before the end of May, accompanied by a statement of the studies which the applicant has already pursued, the examinations he has passed, and the name of a teacher (or teachers) to whom reference may be made. Such applications will be considered by the Dean and Council of the School, who will decide on them according to their merits. A knowledge of elementary mathematics, such as is required of all Royal Exhibitioners and national scholars, will be held to be of the first importance for those who desire admission to the course for the Associateship of the School; while for occasional students, who propose only to take up certain specific branches of science, some preliminary knowledge of them will have weight.

J. F. D. DONNELLY

Science and Art Department, January 14

The Cambridge Cholera Fungus

THE letter published by Dr. Klein in your issue of December 23 (p. 171) having incidentally referred to my views as to the nature of the fungus present in choleraic tissue, I should be glad to be allowed to make some further remarks upon the subject.

At an early stage of his investigation Prof. Roy brought for my inspection one of his preparations of intestinal mucous membrane, which clearly demonstrated the presence of certain foreign organisms, and especially drew my attention to a form which he took to be the more usual and typical one. Such a structure might perhaps best be described as consisting of a thin and somewhat moniliform filament which at one end exhibited a distinct nodular swelling. Being struck with a certain (and, as I now fear, a somewhat superficial) morphological resemblance to a group of the Chytridiaceæ, I suggested that the organism might possibly be a Chytridium, and this view was perhaps too confidently adopted by Messrs. Roy and Sherrington in their paper. The appearance of Dr. Klein's letter has naturally led me to carefully reconsider the whole question, and on further consideration I entirely abandon the idea of the organism being a Chytridium. I believe, on the contrary, that it is a Bacterium, and that the structure described by Prof. Roy and seen by myself is that particular phase in the life-history of the Bacterium which is known as an involution form. Such forms are described, for instance, in Zopf's article "Die Spaltpilze," in Schenk's "Encyclopædie der Naturwissenschaften," as *Bacterium aceti* and *Bacterium cyanogenum*. Indeed, the involution form assumed by the latter Bacterium recalls very vividly to my mind the structure shown to me by Prof. Roy.

In conclusion, I may assure Dr. Klein that the fungus is certainly neither a Penicillum nor of the nature of a mould, and that I do not believe it is in any way associated with *post-mortem* change.

WALTER GARDINER

Royal Gardens, Kew, January 11

Snowstorm of January 7, 1887

A MOST extraordinary snowstorm occurred here to-day (January 7). In fifty years' experience I have seen nothing like it, nor has anyone else in this neighbourhood seen any similar phenomenon. It would be impossible to realise the gigantic size of the snowflakes without seeing them. I can only compare them to a fall of oranges, though the diameter of an orange would be small in comparison with thousands of these snowflakes; in this immediate neighbourhood (*i.e.* within sight of the place of observation) at 50 yards off it produced a dense snow-wall. The wind was south, and almost calm, and the largest snow came down nearly perpendicularly. The temperature was 32°·6, and the air completely saturated with moisture. Before the storm the temperature was 34°·1. Snow had been falling with a slight thaw from 10 a.m., the snowflakes being small. Suddenly, at 12h. 12m. p.m. they became $2\frac{1}{2}$ inches in length;[1] at 12h. 14m. they had increased to $2\frac{3}{4}$ inches; and one flake that was caught measured $2\frac{3}{4}$ inches by $2\frac{1}{2}$ inches, and was $\frac{3}{10}$ of an inch thick. At 12h. 16m. the flakes had increased in size to $3\frac{1}{2}$ inches (and several measured were 4 inches across, and there were several larger ones not near enough to be caught); at 12h. 19m. they were somewhat less, and at 12h. 20m. though large, were not gigantic. Fortunately I was measuring and weighing snow at the time, with two assistants, and had a number of flat circular glasses kept cold ready for the purpose of catching crystals, and for measuring the snow that fell upon these glasses. As is usual when very large flakes are falling, there were many of smaller size, though when the flakes were from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches, the majority of the next size were about 2 inches, and the very large flakes would be within 12 inches of each other. A dozen of these large flakes were caught, each on a separate piece of glass, measured and removed under cover, my two assistants giving valuable aid. Of three of these flakes one yielded 14 drops of water, a second 15, and a third 16 drops; and these were not the largest flakes seen.[2] The water from seven flakes weighed a quarter of an ounce within 2 or 3 grains. The weight of ten varied from 13 to 16 grains each; most of the flakes were about a third longer than broad, one flake that was $3\frac{1}{2}$ inches long by $2\frac{1}{2}$ broad was estimated (before it touched the glass) to be $1\frac{1}{2}$ inch thick, when flattened by the force of its descent it was $\frac{1}{4}$ of an inch thick.

The flakes were not a mass of broken pieces, but were composed mainly of perfect crystals, and there must have been hundreds of these crystals in each flake; they were clinging together at every conceivable angle, though a much larger percentage were more horizontal than vertical. A terrestrial radiation thermometer, buried a fifth of an inch within this snow, marked a temperature of 32°·4.

The snow which fell during the last six minutes of this great storm was just under one-fifth of an inch in depth, and yielded ·030 of an inch of water, falling at the rate of 1 inch of water in three hours and twenty minutes (yielding 1 inch of water from 6 inches of snow).

There was a great snowstorm here on December 27, 1886, which varied considerably in places near to each other, *i.e.*—

	Amount of rain and snow	Depth of snow Inches	Melted snow alone
Shirenewton Hall	1·55	7	0·97
Dennil Hill	1·07	5	0·71
Wirewoods Green	0·86	3	0·42
Piercefield Park	0·96	4	—
Chepstow (The Mount)	0·70	—	—

The drifts above here are very great, and a large number of men are still engaged in cutting through them.

The following measurements will show the number of inches

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[1] The breadth was less than the length, and the thickness less than th breadth; more or less flattened, and curled over on the edges.

[2] Besides these drops, the wetted glass shall count for two more drops.

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